● *For* ARCHITECTS, ENGINEERS AND BUILDING CODE DESIGNERS

STEEL JOIST INSTITUTE

The HAND BOOK *of*

STEEL JOIST

CONSTRUCTION, SPECIFICATIONS
LOADING TABLES AND PROPERTIES

A.I.A. FILE No. 13g

1946 EDITION

» » » THE STEEL JOIST INSTITUTE

STEEL JOIST CONSTRUCTION

●

A HANDBOOK

FOR ARCHITECTS, ENGINEERS
AND BUILDING COMMISSIONERS
ON THE USES AND PROPERTIES
OF STEEL JOISTS

STEEL JOIST INSTITUTE

3709 24th St., N. E., Washington 18, D. C.

PRINTED
IN U. S. A.
1 9 4 6

••• TABLE OF CONTENTS •••

FOREWORD

THE Steel Joist Institute was formed in June of 1928 by a small group of manufacturers of steel joists. It was incorporated under the laws of the State of Illinois in August 1935. The Institute was organized to standardize methods of design and details of construction, to promote proper building regulations, and to disseminate information relative to the proper use and installation of steel joists.

The Standard Specifications adopted by the Institute in December of 1928 led to the development of a standard loading table in August of the following year. This loading table is applicable to the open web steel joists of all manufacturers complying with the Steel Joist Institute Specifications. This table was later adopted as Simplified Practice Recommendation R94-30 of the United States Department of Commerce. In April 1931 a Code of Standard Practice was adopted.

Since the first edition of the Steel Joist Institute Handbook, published in 1932, the book has been revised at intervals to give the architects, engineers and building commissioners essential data for construction and building code regulations. It is with this desire to provide the latest and most complete information on Institute specifications and standards, that we now publish a new and revised edition of STEEL JOIST CONSTRUCTION.

Manufacturers Complying With the Steel Joist Institute Specifications

Bates Expanded Steel Corporation	East Chicago, Ind.
Bethlehem Steel Company	Bethlehem, Pa.
Ceco Steel Products Corporation	Chicago, Ill.
Colorado Builders Supply Company	Denver, Colo.
Concrete Steel Company	New York, N. Y.
Gabriel Steel Company	Detroit, Mich.
Laclede Steel Company	St. Louis, Mo.
Macomber Incorporated	Canton, Ohio
Sheffield Steel Corporation	Kansas City, Mo.
Truscon Steel Company	Youngstown, Ohio

Frank Burton—Consulting Engineer

CATALOGS

Catalogs of any of the individual joist manufacturers, giving complete properties, details and dimensions, will be furnished upon request. Requests for such catalogs should be mailed directly to the manufacturing company.

Open Web Steel Joists for Use in Floor and Roof Construction

Open Web Steel Joists are light weight steel trusses designed for use in light occupancy buildings to support floor and roof panels between main supporting beams, girders, trusses and walls.

Historical

For many years engineers and builders had been seeking a practical means of supporting light weight floors and roofs that would be more fire-resistant than wood and lighter and less expensive than concrete.

In 1855 the first steel joists were used in building the State of New York Bank in New York City. These joists were made of steel webs and flanges riveted together. They were used in various important buildings around Chicago, St. Louis, and Minneapolis before 1905.

In 1908 quantity production of pressed steel joists was started. They were made of 16 gauge sheets pressed into the form of channels and welded back to back, giving the appearance of light I beam sections. Later a section consisting of a strip steel web and four light angles assembled by means of spot welds into the form of a girder made its appearance.

By 1920 considerable progress had been made in getting architects, engineers, building officials, and insurance rating bureaus to accept this type of construction as standard. There remained, however, the objections that the metal was extremely thin and that end connections were expensive. Erection costs were high due to the tendency of joists to tip over. The solid webs offered no practical method of installing pipes and conduits within the depth of the floor construction.

These objections led to the development of the open web joist.

In the year 1923 the first open web joist made its appearance. It was produced in the form of a Warren truss in which the chords consisted of two round bars and the web of a single continuous bent bar. Assembly was accomplished by means of electric arc welding. The chords and webs were made of considerably sturdier sections than those found in pressed steel joists, with little or no increase in the weight of material used. The bearing ends were made 2½" deep in all cases by bending up the bottom chords near the supports. The joists were thereby made inherently stable against overturning which resulted in more speedy and less costly erection. (While this type of end bearing is still considered standard, some manufacturers are now producing joists of other end designs, to accommodate special job conditions.) The use of open web steel joists permit ready passage of pipes and conduits through the openings in all directions, thus providing concealed installations at lower costs.

The design of open web joists has been constantly developed and improved since their first introduction. They are now made by expanding and forming one piece of metal into open web joists, and by assembling several pieces of metal into a joist by welding. Some manufacturers use fusion welding, some resistance welding. Each type has its own inherent advantages and joists of any manufacture certified by the Institute as complying with Steel Joist Institute Specifications can be used with complete safety.

Advantages of Open Web Steel Joist

While steel joists have been primarily developed to provide a more rigid, more fire resistant, and more durable floor than is secured through the use of wood joists, the use of steel joists has many other marked advantages, some of which are listed below:

1. Steel joists are completely standardized as to lengths, depths and carrying capacities. Standard load tables are readily available to the engineer. Steel joist floors are thereby more quickly, easily and accurately designed.
2. Steel joists are completely fabricated in the shop. The standard bearing ends are made 2½" deep by all manufacturers. The point of support is thereby raised above the center of gravity of the joist, and joists will therefore remain upright and not overturn when set in place.
   Note: Some manufacturers are now producing Institute approved joists of other bearing end designs, in order to accommodate special job conditions.
3. When joists rest on brick walls, the 2½" depth of bearing ends generally fits between two successive mortar joints, causing no interference with the brick layout.
4. When supports are at the same levels, the tops of all joists, regardless of depth of joists, lie in the same horizontal plane, thereby providing level bearing surfaces for floors and roof decks.
5. Steel joists are made in standard depths of 8", 10", 12", 14" and 16", and in lengths to accommodate all spans up to 32'-0". They reach the job site tagged and ready for immediate placing, needing only to be hoisted into their proper place and to be attached to supporting members. Highly skilled and expert labor is not necessary. Field costs are thereby greatly reduced.
6. Each joist is a complete, stable and independent unit. As many portions of the floors as is desired may be erected simultaneously. Field work can be speeded up to a high degree and the building completed in shorter time.
7. As soon as joists are erected and bridged, a working platform is available for the immediate follow-up of allied trades, allowing the work to progress more efficiently.

8. The open webs in the joists permit the ready concealment of pipes and electric conduits within the depth of floor, thereby making such installations extremely economical. In many cases, the use of expensive furred ceilings is thereby eliminated.

Fire-Resistance of Steel Joist Construction

In the early days of steel construction, little accurate data was available regarding proper methods and materials for fireproofing. This led to a reaction on the part of building officials, who began to require completely fireproof buildings, regardless of type of building involved.

Recent investigation, however, throws more light on the subject. As a result of fire test determination made at the National Bureau of Standards, it is now possible to express with a reasonable degree of accuracy the severity of fire hazard represented by a given weight of a combustible material in terms of the equivalent fire exposure according to standard fire test specifications. The Bureau performed burnout tests with various concentrations of combustible materials having a calorific value in the range of wood and paper, so assembled as to represent building occupancies. The tests show that the relation between the amount of combustibles present and the severity of the fire is approximately as follows:

Average weight of combustibles lbs./sq. ft. of floor area	Fire Severity
5	½ hour
7½	¾ hour
10	1 hour
15	1-½ hours
20	2 hours
30	3 hours
40	4-½ hours
50	6 hours
60	7-½ hours

In buildings such as apartments, hotels, schools, hospitals, offices, residences, and similar structures having incombustible walls, partitions and floor construction, the total weight of wood floor finish, trim, doors, windows and furnishings varies from an average of from 5 to 10 lbs. per sq. ft. in apartments to 10 to 15 lbs. per sq. ft. in offices. Grouping all such buildings in the class of light occupancies, it is evident that adequate protection against first hazard is provided when the construction will safely undergo a standard one and a half hour fire test.

Tests prove that floor and roof construction composed of steel joists, a 2″ concrete floor slab and a metal lath and plaster ceiling attached directly to the underside of steel joists, will safely withstand a fire as serious in its effects as is developed during a standard one and a half hour fire test. This combination of materials, therefore, makes available an adequate fire-resistive construction for use in light occupancy buildings at a cost of considerably less than that of other standard types of fireproof construction. The cost of this type of construction compares very favorably with that of wood joist construction.

Steel joist fire-resistive construction has rapidly expanded its field of usefulness to a point where many million square feet of floors and roofs are being installed annually. It is exhibiting definite advantages over other combinations of materials and has established a real place for itself in the building industry.

Among the advantages may be listed the following:

1. Steel joist construction provides adequate fire safety for human occupancy buildings at comparatively low cost.
2. Steel joist construction can be carried on in all kinds of weather. The joists can be placed immediately after the main supporting members are erected and, if desired, walls can be built up to the succeeding stories and the entire structure closed in before the concrete slabs are poured.
3. Field work is greatly simplified. Joists can be quickly erected, top lath placed and concrete slab poured. No complicated form work is necessary. The usual mass of shoring is eliminated, permitting complete freedom of movement on the floors below at all times. The absence of combustible forms greatly reduces the risk of serious fires during construction.
4. The lightness of steel joist floor construction permits the use of lighter framing and footings. It is often possible to add one or two additional stories to completed buildings without altering the old columns or footings. Where bad soil conditions are encountered, the lightness of steel joist construction makes its use particularly desirable.
5. Steel joist construction lends itself very readily to the installation of radiant heating.

Wood nailer strips can be attached to open web steel joists at the manufacturers' plants, when required.

The Steel Joist Institute was organized in 1928 for the purpose of placing the joist industry on a rational and scientifically sound basis. In conjunction with the United States Department of Commerce, as outlined in Recommendation R94-30, the Institute has effected a complete standardization of the full range of all steel open web joists, thereby assuring the owner, architect and engineer a product uniformly high in excellence.

Joists produced by the manufacturers complying with Institute standards are subjected to careful inspection. Their design must be analyzed and approved before membership in the Institute is granted.

The extent to which the Steel Joist Institute has succeeded in its endeavors may be judged by the matter contained in its Code of Standard Practice.

Standard Specifications for Steel Joist Construction

Compiled by FRANK BURTON, Consulting Engineer

Adopted by the Steel Joist Institute, December 20, 1928. Effective February 1, 1929. Revised December 12, 1933, April 23, 1941, and April 30, 1946.

Section 100. SCOPE:

(a) These specifications cover the use of "Steel Joist Construction" in any structure to be erected under the provisions of these specifications.

(b) "Steel Joist Construction" as governed by these specifications shall be that type of construction where decks or top slabs, as defined in Section 110 of these specifications, are supported by separate steel members herein referred to as "steel joists", spaced not farther apart than twenty-four (24") inches on centers in floors and thirty (30") inches on centers in roofs, but in no case spaced farther apart than the safe span of the top slab, deck, or flooring over said steel joists. Where such separate steel members are used at wider spacings than specified in this paragraph herein, the construction shall not be considered as "Steel Joist Construction" as defined in these specifications.

(c) Steel joists may be used in all buildings of human occupancy. Steel joists may be used in buildings of store, manufacturing, storage or warehouse occupancy but where such buildings are subjected to unusual concentrated or moving loads, the required live load shall be not to exceed 125 pounds per square foot and the top slab shall be designed to adequately support and distribute such loads and adequate lateral support shall be provided to steel joists to support them against lateral loads.

Section 101. DEFINITION OF STEEL JOIST:

Any steel member suitable for supporting floors and roofs between the main supporting girders, trusses, beams or walls when used as hereinafter specified shall be known as a "steel joist". Such steel joists may be made of hot or cold formed sections, strip or sheet steel, riveted or welded together, or by expanding.

Section 102. MATERIALS:

(a) All steel used shall conform to the American Society for Testing Materials Standard Specifications for Steel for Bridges and Building Designation A7 of latest adoption, except that joists or parts of joists formed of strip or sheet steel shall conform to Grade C of A.S.T.M. Tentative Specifications for Light Gauge Structural Quality, Flat Rolled Carbon Steel (A.S.T.M. A-245-44T or A.S.T.M. A-246-44T) or latest adoption.

(b) All steel joists shall receive one coat of asphalt base paint applied by dipping or spraying, or an equivalent protective covering, before leaving the shop.

Section 103. CONNECTIONS:

(a) All joints of the members that comprise a steel joists shall be made by connecting the members directly to one another by fusion or resistance welds or by rivets. In the case of expanded steel joists, a portion of the metal may be left intact to form a connection. All joints and connections shall be capable of withstanding a load at least three (3) times the designed load and shall be sufficiently rugged to resist the stresses incident to handling and erection when handled in a reasonable manner. Members meeting at a joint shall have their lines of center of gravity meet at a point if practicable; if not, stresses arising from eccentricity shall be included with other stresses in designing the members. In no case shall the eccentricity of any intermediate joint exceed three-quarters (¾) of the least diameter of the largest member connected, but end members may be designed as projecting beams. Ends of steel joists shall be designed to resist the bending produced by eccentricity of the reaction at the support.

(b) In the case of nailer steel joists using wood nailer strips, such wood nailer strips shall be firmly attached to the top chords or top flanges of the steel joists. The nailer strips shall be of a good grade of wood at least 1½" x 1½" in net section. The attachments of the nailer strips shall, in conjunction with the top deck or slab, provide adequate lateral support to the top chords or top flanges of the steel joists.

Section 104.—METHODS OF DESIGN AND STRESSES:

(a) An open web steel joist built up of bars or other sections, or one fabricated by expanding a rolled section, shall be designed as a truss. The compression stress in pounds per square inch in the top chord or diagonals shall not

$$\text{exceed } 15{,}000 \text{ nor} \frac{18{,}000}{1 + \frac{l^2}{18{,}000 r^2}}$$

when the length "l" of the member is the distance clear of welds or other attachments and "r" is the corresponding least radius of gyration of the member or any component part thereof. The ratio of "l" to "r" shall not exceed 120. In the completed structure, the top chords of open web steel joists may be considered as being stayed laterally at panel points when the deck or top slab over the steel joists complies with the provisions of Section 110 of these specifications. The minimum shear to be used in designing the web members at any point in an open web steel joist shall be not less than fifty (50) per cent of the required maximum end reaction for such

steel joist. In computing the resistance of open web steel joists to loads incident to construction as described in Section 107(c) of these specifications, the top chords shall satisfy the additional requirements that they shall safely carry the resulting compression using "*l*" as the distance between lines of bridging and "r" as the least radius of gyration of the top chord of any one steel joist around a vertical axis but the ratio of "*l*" to "r" in this case shall not exceed 200; however, the permissible stresses in pounds per square inch as established elsewhere in this section 104 (a) may be increased by one-third. In no case shall the lines of bridging be spaced farther apart than that permitted in Section 108(b). No bending stresses shall be assumed in top chords of open web steel joists supporting poured concrete slabs which have a thickness of more than one-fourteenth (1/14) of the distance between supports under the top chords, but for open web steel joists supporting concrete slabs thinner than this, the theoretical bending stress for a uniform load shall be computed and subtracted from the allowable stress. In the design of open web nailer steel joists, the nailer strips shall not be assumed to carry any part of the stresses in the steel joists but, if adequate, may be assumed to carry the supported load to the panel points. When bending stresses in top chords of open web steel joists must be considered, the combined axial compression and bending stress at the center of the panel shall not exceed the permissible compression stress set forth above in this paragraph and at points of vertical support of the top chords shall not exceed eighteen thousand (18,000) pounds per square inch. The tensile stress shall not exceed eighteen thousand (18,000) pounds per square inch in any member.

(b) A solid web steel joist shall be designed as a beam. The maximum fiber stress in tension shall not exceed eighteen thousand (18,000) pounds per square inch. The maximum fiber stress in compression shall not exceed eighteen thousand (18,000) pounds per square

$$\text{inch nor } \frac{20{,}000}{1 + \dfrac{l^2}{2000\ b^2}}$$

when the length "*l*" is the distance between lateral supports of the compression flange, and "b" is the width of the compression flange. The greatest average shear in pounds per square inch on the gross area of the web shall not exceed

$$12{,}000 \text{ nor } \frac{18{,}000}{1 + \dfrac{h^2}{7200\ t^2}}$$

when "h" is the clear distance between flanges and "t" is the thickness of the web. When the web of a solid web steel joist is made of two or more sheets of metal, each sheet shall be considered as a separate member, each sheet carrying its share of the shear.

In the completed structure, the top flanges of solid web steel joists may be considered as being stayed laterally when the deck or top slab over the steel joists complies with the provisions of Section 110 of these specifications. In computing the resistance of solid web steel joists to loads incident to construction as described in Section 107(c) of these specifications, the top flanges shall satisfy the additional requirements that they shall safely carry the resulting compression, using "*l*" as the distance between lines of bridging and "b" as the width of the compression flange, but the ratio of "*l*" to "b" shall not exceed 40; however, the permissible stresses in pounds per square inch as established elsewhere in this Section 104(b) may be increased by one-third In no case shall the lines of bridging be spaced farther apart than that permitted in Section 108(b). In the design of solid web nailer steel joists the nailer strips shall not be assumed to carry any part of the stresses in the steel joists.

(c) When a wood sleeper (nailing screed) is placed in a top slab of poured concrete not less than two (2") inches thick and as specified in Section 104 (a), bending stresses in the top chord of an open web steel joist need not be considered, provided the wood sleeper (nailing screed) is elevated a minimum of one (1") inch above the top chord of the steel joist. In the case of an open web nailer steel joist, bending stresses in the top chord need not be considered, provided a wood nailer strip adequate to carry the supported load to the panel points is attached to the top chord in accordance with the provisions of Section 103(b) of these specifications. When precast interlocking top slabs are used over open web steel joists and are of sufficient width and rigidity to transmit a uniform floor or roof load to the panel points without the assistance of the top chords between panel points, bending stresses in the top chords need not be considered.

Section 105. SPAN:

(a) The span of steel joists shall not exceed twenty-four (24) times the depth of the steel portion of the steel joist.

(b) The span of open web steel joists shall not exceed five hundred fifty (550) times the least radius of gyration of the top chord around a vertical axis, but in case the top chord consists of a flat top section continuous with a center web, the radius of gyration of the top plate alone shall be taken.

Section 106. SPACING:

The spacing of steel joists in "Steel Joist Construction" shall be in compliance with the provisions of Section 100(b) herein. In other than "Steel Joist Construction", steel joists may be used, in accordance with the provisions of Section 113 of these specifications, at spacings greater than that permitted by Section 100(b) herein, to support roof decks.

Section 107. ERECTION:

(a) The ends of steel joists shall extend a distance of at least four (4") inches onto masonry or reinforced concrete supports and at least two-and-one-half (2½") inches on steel supports. Every third steel joist on concrete or masonry supports shall be

anchored thereto with an anchor equivalent to a three-eights (⅜") inch round. The ends of all steel joists supported on masonry walls shall be bedded in mortar.

(b) All steel joists supported on steel beams shall be secured thereto with an anchor made of not less than a three-sixteenths (3/16") inch round bar fastened over the flanges of the supporting beams except in the case of buildings having a height of more than twice the least dimension of the base, in which case each steel joist shall be welded to the supporting steel work with two (2) welds at each end, each one (1") inch long, or by means of a one-half (½") inch bolt or rivet at each end. In the case of buildings having a height of more than two and one-half times the width of the base, the structural frame and floors must be depended upon to distribute the wind load horizontally. At all supports where the steel joists are anchored with a hook anchor only, and in buildings having a height of more than two (2) times the width, the top lath or other centering shall be cut and formed to permit concrete of top slab to fill space around the ends of the steel joists.

(c) All steel joists shall be fastened in place and permanent bridging installed before any construction loads (except the weight of the necessary workmen to install the bridging) are placed upon the steel joists.

(d) During the construction period, care shall be exercised to prevent excessive concentrated or moving loads. The construction contractor shall provide for adequate distribution of such loads so that the carrying capacity of any steel joist is not exceeded during that period.

Section 108. BRIDGING:

(a) As soon as steel joists have been erected, bridging shall be installed between them before the application of construction loads. This bridging shall be adequate to safely support the top chords or flanges against lateral movement during the construction period and shall hold the steel joists in an approximately vertical plane passing through the bearings. The steel joists at the ends of panels shall be braced laterally by anchors or ties at each line of bridging. If diagonal bridging is used in which all diagonal members will resist only tension, they shall not be less than a three-sixteenths (3/16") inch round rod, and these diagonals shall be supplemented by a continuous strut adequately attached to the top chords or flanges of all steel joists so bridged. This top strut shall be equivalent as a strut to a one-half (½") inch round steel bar. If diagonal members are used which are capable of resisting both tension and compression, the top strut may be omitted. In case bridging in the form of horizontally placed beam or angle sections is provided, it must be so connected to the steel joists that it will support the top chords or flanges against lateral movement and hold the steel joists approximately in a vertical plane. Fourteen (14) gauge wire diagonals shall be used to secure the bottom chords or flanges at each line of bridging of this type. Wire may be omitted when bridging which restrains both top and bottom chords or flanges is used.

(b) The number of lines of bridging provided shall be not less than that specified in the following table:

Span	Number of Lines of Bridging
up to 14 feet	one row near center.
14 to 21 feet	two rows placed at approximately ¼ span apart and symmetrically disposed about the center of span.
21 to 32 feet	three rows placed at approximately ¼ points of span.

(c) In the case of nailer steel joists carrying a wood deck, the wood deck may be used as the top member of the bridging system.

Section 109. FLOOR & CEILING PROTECTION OF STEEL JOIST CONSTRUCTION:

(a) Non-fire Resistive Construction—When used in any structure where wood joists are permitted, steel nailer joists may be used and wood floor may be used over such steel joists.

(b) Fire Resistive Construction—Wherever any structure requires fire resistive construction, steel joists may be used, provided they are protected as indicated below:

(1) **One-Hour Fire Resistance.***
Floor: 2" reinforced concrete, 2" reinforced gypsum, or 2" precast gypsum tile.
Ceiling: ¾" Portland cement sand plaster 1:2 for scratch and 1:3 for brown coat with 15 lb. of hydrated lime and 3 lb. of short asbestos fiber per bag of Portland cement, or ¾" sanded gypsum plaster 1:2 for scratch coat and 1:3 for brown coat.

(2) **One-and-One-Half-Hour Fire Resistance.***
Floor: 2" reinforced concrete, 2" reinforced gypsum, or 2" precast gypsum tile.
Ceiling: ¾" Portland cement and sand plaster 1:2 for scratch and 1:3 for brown coat with 15 lb. of hydrated lime and 3 lb. of short asbestos fiber per bag of Portland cement, or ¾" sanded gypsum plaster 1:2 for scratch coat and 1:3 for brown coat.

(3) **Two-Hour Fire Resistance.***
Floor: 2¼" reinforced concrete, 2" reinforced gypsum, or 2" precast gypsum tile, the latter with ¼" mortar finish.
Ceiling: ¾" sanded gypsum plaster 1:2 for scratch coat and 1:3 for brown coat.

(4) **Two-and-One-Half-Hour Fire Resistance.***
Floor: 2" reinforced concrete, 2" reinforced gypsum, or 2" precast gypsum tile, the latter with ¼" finish.
Ceiling: 1" neat gypsum plaster or ¾" gypsum-vermiculite plaster, ratio of weight of gypsum to fine heat-expanded vermiculite in the range of 2:1 to 3:1.
or
Floor: 2½" reinforced concrete.
Ceiling: ⅞" sanded gypsum plaster 1:2 for scratch coat and brown coat.

(5) **Three-Hour Fire Resistance.***
Floor: 2½" reinforced concrete, 2" reinforced gypsum, or 2" precast gypsum tile, the latter with ½" mortar finish.
Ceiling: 1" neat gypsum plaster or ¾"

gypsum-vermiculite plaster, ratio of weight of gypsum to fine heat-expanded vermiculite in the range 2:1 to 3:1.

(6) **Four-Hour Fire Resistance.***

Floor: 2½" reinforced concrete, or 2" reinforced gypsum slabs, the latter with ½" mortar finish.

Ceiling: 1" gypsum-vermiculite plaster applied on metal lath and proportioned in the range 2:1 to 3:1 of gypsum to heat expanded vermiculite by weight.

***Notes applying to paragraphs (b) (1) to (b) (6) inclusive:**

The plaster for the ceiling shall be applied on metal lath of the appropriate weight for the spacing of the supports or other plaster bases as may be approved by the Steel Joist Institute. The lath shall be tied to the supports to give the equivalent of single No. 18-gauge steel wire ties at 5-inch centers.

The thickness of plaster shall be the depth from the back side of flat lath and to the back of the flat portion of ribbed lath.

The slab thicknesses are measured from the top flange of the joists and unless otherwise indicated are for monolithic poured construction.

Precast slabs shall have joints grouted.

Wood nailers may be placed in top slabs provided they are separated from the top of the steel joists by the following minimum thickness of concrete or gypsum:

1-½ Hour Fire Resistive Construction	1 inch
2 Hour Fire Resistive Construction	1-⅛ inch
2½ Hour Fire Resistive Construction	1-⅜ inch
3 Hour Fire Resistive Construction	1-⅝ inch
4 Hour Fire Resistive Construction	1-⅝ inch

Section 110. DECKS AND TOP SLABS:

(a) Decks or top slabs over steel joists may be of concrete or gypsum poured on metal lath centering attached to the top chords or flanges of steel joists as required elsewhere in this section or on removable centering, provided the top chords or flanges of the steel joists are properly stayed by the concrete or gypsum slab. Other equally suitable permanent centering may be used, provided it is substantially attached to the top chords or flanges as required elsewhere in this section and provided these attachments (or the centering itself) are securely anchored into the concrete or gypsum slab. Precast concrete or precast gypsum slabs when securely attached to the top chords or flanges and anchored thereto and brought to a firm bearing, wood decks as specified in these specifications and corrugated or other steel roof decks securely anchored to the top chords or flanges may be used over steel joists. Any attachment or pair of attachments when applied shall be capable of staying the top chord flange laterally in both directions and in the case of open web steel joists, shall be spaced not farther apart than the panel point spacing. Decks or top slabs over steel joists shall not be assumed to carry any part of the compression stress in the steel joist.

(b) Flat wood decks of single thickness of seven-eighths (⅞") inch material shall not have a span of more than twenty (20") inches for floors, or thirty (30") inches for roofs. All such decks shall be securely fastened to the nailer strips.

(c) Poured structural slabs of concrete, gypsum or other similar material shall not be less than two (2") inches thick. They shall be poured upon three-eighths (⅜") inch ribbed metal lath weighing not less than four (4) pounds per square yard for spans not exceeding 24 inches and upon three-quarter (¾") inch rib lath weighing not less than .60 pounds per square foot for spans not exceeding 30 inches. Other material equally suitable as a form or centering for casting concrete or gypsum slabs may be used in place of rib lath. Rib lath or other centering which remains in place shall be substantially attached to the top chord or flange of each steel joist at intervals of not over eight (8") inches. Such slabs shall be reinforced with mesh or rods, equivalent to ¼" rounds at 12" cc placed both perpendicular and parallel to run of joists, in addition to the rib lath, except that when slabs are to be covered with a wood strip top floor, the rib lath or centering may, if adequate, serve also as the reinforcement.

(d) Any material used as centering for the top slab shall be installed so as not to exert an undue lateral pull on the top chords or flanges of the steel joists or parallel steel or masonry structural members.

Section 111. DEFLECTION:

The deflection of the finished floor due to the designed live load shall not exceed one three hundred sixtieth (1/360) of the span. The permanent deflection resulting from loading a finished floor to twice the designed live load for twelve (12) hours shall not exceed twenty (20%) per cent of the total deflection for this load.

Section 112. FACTOR OF SAFETY:

The maximum total uniform load at failure of a steel joist floor shall not be less than two (2) times the total designed load of steel joists as computed by using the stresses permitted herein. Steel Joist Construction, if required to be tested, shall have bridging and top deck applied as ordinarily used and the test load shall be uniformly distributed.

Section 113. ROOF DECKS:

Where roof decks are used, steel joists may be used at spacing in excess of the limitations prescribed in Section 100(b) of these specifications. However, where such wider spacings are used, the construction shall not be considered as "Steel Joist Construction" as defined in these specifications but shall be designed and constructed in accordance with recognized engineering practice to safely support all loads without exceeding the unit stresses specified in these specifications.

Note: It is recognized that the preceding full specification for steel joist construction is too lengthy for incorporation complete into building codes and ordinances. Therefore, the Steel Joist Institute suggests that the following abbreviated regulations may be used in Building Code Regulations.

Recommended Abbreviated Regulations for Use in Building Codes

Adopted April 30, 1946

Section 100. SCOPE:

Steel joist construction as governed by the requirements of this section shall be that type of construction in which decks or top slabs are supported by separate steel members herein referred to as "steel joists", spaced not farther apart than 24" on centers in floors and 30" on centers in roofs, but in no case spaced farther apart than the safe span of the top slab deck, or floor. Such joists may be made of hot or cold-formed sections, strip or sheet steel, riveted or welded together, or by expanding.

Where steel joists are used at wider spacings than specified in the paragraph above the construction shall not be considered as "steel joist construction" but shall be designed and constructed in accordance with recognized engineering practice without exceeding the unit stresses specified herein.

Steel joist construction may be used in all buildings of human occupancy. Steel joist construction may be used in buildings of store, manufacturing, storage or warehouse occupancy; but where such buildings are subject to unusual concentrated or moving loads, use of steel joist construction for floors shall be limited to live loads not exceeding 125 lbs. per sq. ft. and adequate top slab and lateral support shall be provided to support and distribute such loads.

Section 101. MATERIAL:

Steel shall conform to the requirements of the Standard Specifications for Steel for Bridges and Buildings, (A.S.T.M. A7) of latest adoption, except that joists formed of strip or sheet steel shall conform to Grade C of A.S.T.M. Tentative Specifications for Light Gauge Structural Quality, Flat Rolled, Carbon Steel (A.S.T.M. A-245-44T or A.S.T.M. A-246-44T) or latest adoption.

Section 102. DESIGN AND MAXIMUM STRESS:

Open web steel joists shall be designed as a truss, solid web steel joists as a beam. Deck or top slabs over steel joists shall not be assumed to carry any part of the compression stress in the steel joists.

For steel meeting the requirements of Section 101, the maximum design stress shall not exceed 18,000 lbs. per sq. in.

Compression chords and diagonals of open web steel joists shall not have a ratio of length (clear distance between welds or attachments) to least radius of gyration in excess of 120, nor shall the unit compression stress exceed 15,000 lbs. per sq. in.

Section 103. PROTECTIVE COATING:

All steel joists shall receive one coat of asphalt base paint applied by dipping or spraying, or an equivalent protective covering, before leaving the shop.

Section 104. MANUFACTURE:

All joints of the members that comprise a steel joist shall be made by connecting the members directly to one another by fusion or resistance welds, or by rivets.

In the case of expanded steel joists, a portion of the metal may be left intact to form a connection.

In the case of nailer joists, wood nailer strips shall be firmly attached to the top chord of the joist. Such nailer strips shall be of good grade wood at least 1½" x 1½" in net section.

Section 105. ANCHORAGE:

The ends of steel joists shall extend a distance of at least four inches onto masonry or reinforced concrete supports, and at least two and one-half inches on steel supports. Every third steel joist bearing on concrete or masonry supports shall be anchored thereto with an anchor equivalent to a ⅜ inch round. The ends of all steel joists supported on masonry walls shall be bedded in mortar.

All steel joists supported on steel beams shall be secured thereto with an anchor made of not less than a 3/16 inch round bar fastened over the flanges of the supporting beams, or other equivalent approved attachment, except that in the case of buildings having a height of more than twice the least dimension of the base, each steel joist shall be welded, bolted or riveted to the supporting steel work.

Section 106. SPAN:

The span of steel joists in steel joist construction shall not exceed 24 times the depth of the steel portion of the steel joist.

Section 107. BRIDGING:

As soon as steel joists have been erected and before application of construction loads, bridging shall be installed between them. This bridging shall be adequate to safely support the top chords or flanges against lateral movement during the construction period and shall hold the steel joists in an approximately vertical plane passing through the bearings. The steel joists at the ends of panels shall be braced laterally by anchors or ties at each line of bridging.

The number of lines of bridging shall be: one row, near the center, for spans up to 14 feet; two rows, approximately one quarter span apart, for spans 14 to 21 feet; and three rows for spans 21 to 32 feet.

In the case of nailer steel joists carrying a wood deck, the wood deck may be used as the top member of the bridging system.

Section 108. CEILING PROTECTION:

Where fire-resistive construction is required, steel joists shall be protected on the underside with a fire-resistive ceiling and shall have a reinforced concrete or gypsum top slab, all as is necessary for the assembly to provide the required degree of fire resistance, provided that where wood-joist construction is permitted, steel joists may have a wood nailing strip attached to the top chord or top flange and a wood floor may be used, and provided further that where steel joists are used in places where unprotected wood joists are permitted, no ceiling protection need be provided.

Section 109. DECKS OR TOP SLABS:

Decks or top slabs over steel joists may be of concrete or gypsum poured on metal lath centering or equally suitable permanent centering, or on removable centering, provided the top chords or flanges of the steel joists are stayed laterally by the top slab.

Precast concrete top slabs, precast gypsum top slabs, wood decks, or steel decks may be used over steel joists provided they are securely anchored to the top chords or flanges of the joists.

Section 110. ACCEPTED PRACTICE:

In the absence of specific requirements as provided in this section, steel joist construction shall be governed by accepted engineering practice as defined in the Standard Specifications for Steel Joists of the Steel Joist Institute (latest edition.)

Code of Standard Practice of the Steel Joist Institute

Adopted April 7, 1931. Revised April 30, 1946.

Section 1. GENERAL.

1.1 Scope. The practices and customs contained in this code are in accordance with good engineering practice, tend to secure safety in steel joist construction, and are standard within the industry. This code is made a part of every contract between the Buyer and Seller of steel joists and accessories thereto unless specific provision to the contrary is made. This code contemplates the Seller as a company manufacturing steel joists but without any responsibilities in the matter of erecting them. Whenever the Seller shall contract to erect the joists he shall assume the usual obligations of a subcontractor in addition to the obligations set forth herein.

1.2 Application. This Code of Standard Practice is to govern as a standard in those cases where the provisions of building codes, architects' and engineers' plans and specifications, or contracts are not complete or clear. There shall be no conflict between this code and any legal building regulation; this Code shall only supplement and amplify such laws.

1.3 Design. In the absence of ordinances or specifications to the contrary, all designs shall be in accordance with the Standard Specifications of the Steel Joist Institute adopted December 20, 1928, and as subsequently amended.

1.4 Plans for Bidding. Plans to serve as a basis for bids shall be completed as to location of all bearing walls, steel and concrete supporting members, floor openings, partitions and other dead loads, and the material and thickness of floor or roof deck and ceiling shall be specified.

1.5 Responsibility for Design and Erection. When details of design are specified the Seller shall assume no responsibility other than to furnish all steel joist materials specified. When details of design are not specified the Seller shall furnish all materials required in this Code. In neither case shall the Seller assume any responsibility for the erection of the materials furnished.

Section 2. APPLICATION.

When the floor or roof deck is of concrete, all joists furnished shall be fabricated entirely of steel and shall conform to the Standards of the Steel Joist Institute and the United States Department of Commerce Simplified Practice Recommendation No. R 94-30. When the floor or roof deck is of wood or sheet metal, steel joists having a wood nailing strip attached may be provided.

Section 3. ESTIMATING.

3.1 Complete Plans and Specifications. When plans are complete as to all materials required, estimates shall include such of the following items as are specified and no others, and shall be quoted as estimate on joists and accessories:

Joists.
Ceiling extensions if necessary for properly supporting ceiling lath.
Bridging.
Wall and beam anchors.
Joist bearing plates if necessary.

Materials for framing all openings not exceeding four (4) feet at right angles to run of joists unless otherwise specified. Beveled plates or other means of attachment for roof or ramp rakes.

The following shall be quoted as separate items:

Top lath or other permanent centering for concete decks.

Top lath clips.

Screed chairs if to be attached to joists.

Clamps to hold metal decking against wind uplift and stay top chords of joists when metal decks are to be supported on steel joists, unless specified to be furnished by seller of deck.

When the following items are specified they may be estimated but shall be quoted as a separate item:

Ceiling lath.

Clips for attaching ceiling lath.

3.2 Incomplete Plans and Specifications. When plans and specifications are incomplete in any particular, estimate shall include such material as is required by the provisions of paragraphs 3.3 to 3.9 and estimates shall be segregated and quoted as required in paragraph 3.1.

3.3 Joists, Location and Spacing. All joists shall be designed according to the Steel Joinst Institute Standards and the maximum spacing shall not exceed the requirements of the Standard Specifications of the Steel Joist Institute. Also the spacing shall not be greater than that which will give a calculated total carrying capacity at least equal to that required in this section. In all cases there shall be one typical joist not more than four (4) inches in the clear from each end wall or other self-supporting walls parallel to run of joists. Where partitions extend parallel to run of joists there shall be at least one typical joist provided under each such partition and more than one such joist shall be provided if necessary to safely support the weight of such partition and the adjacent floor less the live load on a strip of floor one foot in width. Where partitions extend across run of joists their weight shall be included in the dead load as required in paragraph 3.9. In spacing joists, tie beams in steel frame buildings shall not be considered as taking the place of a joist unless the resisting moment of the tie beam is at least as great as that of a typical joist.

3.4 Bridging. All bridging shall be a bridging complying with the Standard Specifications of the Steel Joist Institute. No estimate shall be based upon wire bridging.

3.5 Floor Lath. The amount of lath estimated shall be 15 per cent more than the total area of floors and roof within walls after deducting all openings in excess of 100 square feet in area. The lath shall meet the Standard Specifications of the Steel Joist Institute. Enough lath clips shall be estimated to attach lath at intervals of eight inches on each joist.

3.6 Ceiling Lath. No ceiling lath shall be included in estimate unless it is definitely specified, in which case it shall be estimated upon the same basis both for lath and clips as is required for Floor Lath, but the price of ceiling lath and clips shall be quoted as a separate item.

3.7 Temperature Reinforcing. Where wood strip finished floors are specified, no temperature steel shall be included in estimate unless specified. For all other types of floor finish temperature steel equivalent to ¼-inch rounds 12 inches on centers both perpendicular and parallel to run of joists shall be provided, or mesh of equivalent sectional area.

3.8 Special Details. The following items shall not be estimated:

Frame materials for openings more than four (4) feet wide at right angles to run of joists. All such framing shall be in structural steel.

Shelf angles and clip angles required on steel work for support of joists.

3.9 Loads. The loads to be used in designs shall be not less than the following and in no case less than the actual load when such load is definitely known.

Dead Load. Joists, actual weight but not less than 3 pounds per sq. ft. of floor area.

Concrete floors, 12 pounds per inch of thickness per sq. ft. of floor area.

Ceiling not less than 9 pounds per sq. ft. of floor area.

Wood floor finish not less than 3 pounds per sq. ft. of floor area.

Any special dead load for machinery, pipes or other details shall be included as specified by architect.

Partitions. The weight of partitions shown upon plans shall be taken as follows in pounds per square foot:

	Unplastered	Plastered
3″ clay tile	17	27
4″ clay tile	18	28
6″ clay tile	28	38
3″ gypsum tile	10½	18½
4″ gypsum tile	12½	20½
6″ gypsum tile	18½	26½
4″ brick	40	48
8″ brick	80	88
Metal lath and studs		18½

When partitions are not definitely shown on plans the following loads in pounds per square foot of floor area shall be used for the purposes of making estimates:

Schools, churches, theatres, auditoriums, garages. None.

Apartments, residences, parish houses and similar buildings. 15 pounds per square foot.

Offices, hotels, hospitals, asylums, college dormitories and similar buildings. 20 pounds per square foot.

Live Loads. Live loads used in design shall be in accordance with architect's specification, local or state regulations. In absence of all these the minimum live load used shall be as follows:

Occupancy or Use	Live Load
Apartment houses:	
Private apartments	40
Public stairways	100
Assembly halls:	
Fixed seats	60
Movable seats	100
Corridors, upper floors	100
Corridors:	
First floor	100
Other floors, same as occupancy served except as indicated	
Courtrooms	80
Dance halls	100
Dining rooms, public	100
Dwellings	40
Hospitals and asylums:	
Operating rooms	60
Private rooms	40
Wards	40
Public space	80
Hotels:	
Guest rooms	40
Corridors serving public rooms	100
Public rooms	100
Loft buildings	125
Manufacturing, light	125
Office buildings:	
Offices	80
Lobbies	100
Schools:	
Classrooms	40
Corridors	100
Stores	100
Theaters:	
Aisles, corridors, and lobbies	100
Orchestra floor	60
Balconies	60
Stage floor	150

Mercantile, manufacturing, and storage buildings should not be estimated without data as to probable loads, but in no case shall the load be taken as less than 100 pounds.

Roofs south of latitude 37° ..... 20 pounds
Between latitude 37° and 45° ..... 30 pounds
North of latitude 45° ..... 40 pounds

Except that in high altitudes the loads shall be taken as ten pounds greater than as given above.

Section 4. DRAWINGS AND SPECIFICATIONS.

4.1 Plans Furnished by Buyer. The Buyer shall furnish the Seller a set of plans showing the layout of all walls, columns, beams, girders, and other supports, as well as floor openings and partitions correctly dimensioned. The live loads to be assumed, the weights of partitions and the location and amount of any special loads such as fans, blowers, tanks, etc., shall be indicated. The level of finished floors and roofs and the level of all joist bearings shall be shown.

4.2 Plans Furnished by Seller. The Seller shall furnish to the Buyer detailed plans showing the location of all joists with joists marked to correspond to bill of material and to the tags upon the joists. All necessary details and notes shall be supplied to show the proper installation of bridging, beam and wall anchors, ceiling extensions, bearing plates, lath clips, screed clips, and temperature steel.

4.3 Discrepancies. The Architect's plans will be assumed to be correct in absence of written notice from Buyer to the contrary. When detailed steel or concrete plans are furnished by Buyer which do not agree with Architect's plans, such detailed plans shall be considered as a written notice of change of plans.

4.4 Approval. The detailed plans prepared by the Seller shall be submitted to the Buyer for approval, unless Buyer instructs Seller to submit same directly to Architect. The Buyer (or Architect) shall return one copy of plans marked with his approval or with such corrections as he may deem necessary. The plans shall be corrected by the Seller if necessary and returned to the Buyer for final approval. The Seller shall not proceed with shop work until plans are finally approved by Buyer (or Architect). The Seller shall furnish to the Buyer as many blue prints of detailed plans as may be reasonably necessary, but the tracings shall remain the property of the Seller.

4.5 Changes by Buyer After Approval. When any changes in plans are made by Buyer after approval of detailed drawings or when any extra materials are required not shown on such drawings, the cost of such changes and/or extra materials shall be paid by the Buyer at a price to be agreed upon between Buyer and Seller at the time such changes and/or extra materials are ordered.

Section 5. MATERIALS.

5.1 Grade of Steel shall comply with the requirements of the Standard Specifications of the Steel Joist Institute.

5.2 Joists shall be of any type meeting the requirements of the Standard Specifications of the Steel Joist Institute and shall be a Standard Joist as given in the Loading Tables of the Steel Joist Institute.

5.3 Maximum Lengths. Joists shall not have a span exceeding twenty-four (24) times their depth.

5.4 Bridging shall be of a type meeting the requirements of the Standard Specifications of the Steel Joist Institute. Wire bridging shall not be used.

5.5 Anchors for walls and beams shall comply with the Standard Specifications of the Steel Joist Institute in size and number.

5.6 Bearing of Joists shall not be less than 2½ inches net on steel and 4 inches net on masonry. Bearing plates shall be provided if necessary to reduce the unit bearing pressure on masonry to not more than 200 pounds per square inch.

5.7 Ceiling Extensions. Whenever a ceiling is to be attached to the bottom chord of joists, a furring extension rod or unit shall be provided for each end of each joist when necessary to properly support ceiling.

5.8 Headers. Floor and roof openings not exceeding 4 feet in width measured at right angles to run of joists shall be framed with beam, angle, or channel headers of ample strength to support joist reactions. Such header beams, angles or channels, together with necessary bolts, clips or other devices for securing same to trimmer joists as well as to joists supported, shall be furnished by Seller. When the reaction from such headers exceeds 400 pounds, the load shall be transmitted to the trimmer joist without relying upon bending in top or bottom chord.

5.9 Paint. All joists, before shipment, shall be given one coat of good paint by dipping or spraying. The base of such paint shall be an asphaltic bitumen containing not over 10% of carbon pigment and not over 10% of saponifiable material. The paint shall dry to a firm, elastic film before joists are loaded for shipment, and shall not soften sufficiently to drip at 120° F.

5.10 Inspection. The Seller shall inspect all joists at time of fabrication and shall be responsible as to accuracy of size, span, assembly and the sufficiency of welding. All other inspection work shall be at the expense of the Buyer and shall be performed at the Seller's place of manufacture.

Section 6. ERECTION.

6.1 The Seller shall not perform the work of erecting joists or accessories and shall not be responsible for the safety of beams, columns, walls or other supporting members.

6.2 The Seller shall not be responsible for the actual dimensions of construction work in field, but shall be responsible for the accurate fabrication of joist materials in accordance with Architect's plans or any changed plans furnished by Buyer before final approval of shop drawings.

6.3 The Seller shall furnish to Buyer proper instructions relative to methods of erection, bridging and anchoring of joists and the Buyer shall be responsible for the correct execution of such instructions.

Section 7. BUSINESS RELATIONS.

7.1 Presentation of Proposals. All proposals for furnishing steel joists and accessories thereto shall be made on a Sales Contract Form. After acceptance by the Buyer, these proposals must be approved or executed by a qualified official of the Seller. Upon such approval the proposal becomes a contract.

7.2 Acceptance of Proposals. All proposals are intended for prompt acceptance and are subject to change without notice.

7.3 Billing. Contracts on lump sum basis are to be billed proportionally as shipments are made.

7.4 Arbitration. All business controversies which cannot be settled by direct negotiations between Buyer and Seller shall be submitted to arbitration. Both parties shall sign a submission to arbitration and if possible agree upon an arbitrator. If they are unable to so agree, each shall appoint an arbitrator and these two shall appoint a third arbitrator. The expenses of the arbitration shall be divided equally between the parties, unless otherwise provided for in the agreement to submit to arbitration. The arbitrators shall pass finally upon all questions both of law and fact, and their findings shall be conclusive.

Recommendations of the Steel Joist Institute With Regard to Handling and Erection of Steel Joists

UNLOADING. Steel Joists, being light members, are often seriously damaged by careless handling. They should not be thrown over the sides of car or off of trucks. A crane may advantageously be used for unloading, but if it is contemplated that a crane will be used, the Seller should be notified of the fact so that joists can be properly blocked during loading.

(A) If a crane is used it should be provided with twin chains supporting the joists at two points some distance apart, and the joists should be handled carefully and not jerked or dropped.

(B) Buyer should determine from plans the length of joists, and provide truck of proper length, and trailer if necessary, to adequately support joists.

HAULING. Joists should not be allowed to overhang end of truck by more than a few feet, otherwise the joists may be permanently bent. If a truck long enough to support the joists is not available, a trailer should be supplied. In loading on trucks, cross timbers should be inserted at intervals to keep the piles true. The timbers should be placed vertically above one another to prevent undue bending in the lower joists.

PILING AT JOB. Joists, accessories and lath should be stored at job in such a manner that the lower portion of the piles is not affected by ground dampness. Piles should not be so high as to cause bending in members near the bottom. Piles of materials should be protected from the weather with waterproof covers. In piling material, all shipping tags should be placed at the same end and in an accessible position. Materials required for upper floors or roof should not be placed above that to be used on lower floors.

SETTING JOISTS. The first joist in any run should be placed not more than 4 inches clear of the end wall. The other joists should be spaced accurately, measuring from the first joist. Joists should be laid upon supports, and not thrown on. Joists supported on masonry walls should be bedded in mortar. The failure to properly bed joists will often result in excessive vibration in the finished floor. If a system of rigid bridging is used in which the diagonals act in both tension and compression, it shall be installed before wall anchors, beam anchors or other specified means of attachment are applied. If beam or tension bridging is used, it shall be installed after joists are permanently anchored to the supports. This should always be done before any other work is performed which requires support from the joists. The safety and success of the work depends largely upon the faithful installation of the bridging in strict accordance with detailed plans.

DECKING. No temporary decking or run-ways except planks used by workmen in installing bridging should be placed on floors until all bridging is in place. Two-inch nominal planks should then be provided for temporary decks and run-ways. Also spreader boards should be provided for dumping of concrete buggies. This will avoid excessive loss of mortar from concrete, which will result if concrete is dumped directly on lath.

CONSTRUCTION LOADS. Steel joists are designed to safely support a concentrated load of 800 pounds on any one panel point or any joist, but only after bridging is in place. Moving or vibrating concentrated loads exceeding 400 pounds should be distributed by means of temporary blocking to two or more joists. Any stationary construction load exceeding the designed floor load, or any moving construction load exceeding one-half of this amount must be distributed by means of timbers to walls, girders or columns. The builder should remember that steel joist floors are not supported from floor to floor with temporary shoring. Each floor is structurally independent. The designed live load of most light occupancy buildings, such as hotels, apartments or schools is usually about 50 pounds per square foot, which is equal to a six inch layer of sand, gravel or brick. The mixing of concrete on roofs or upper floors is not feasible unless mixer and materials are supported on an adequate temporary timber platform resting upon structural beams or girders, or upon masonry bearing walls.

CENTERING. The floor lath or other centering should be securely attached to top of joists with top lath clips or other devices furnished by Seller. These attachments perform a very important function in the finished construction. Whenever any centering material is used which transmits a lateral pull to joists during concreting, it is important that temporary blocking be placed snugly between the joists near the ends, as well as at points intermediate between lines of bridging, if necessary to prevent lateral bending of joists. Floor lath should be lapped not less than 1½ inches beyond center of supporting joists at ends of sheets and should be securely wired to next sheet. At supports the lath should be cut on each side of joist and bent down to inner line of wall or girder, permitting concrete to seal ends of joists. Failure to properly seal the ends of joists is an important factor contributing to vibration in finished floors. A continuous sealing of the ends of joists over beams and interior partitions is also of great value in preventing the transmission of sound from the place of origin to distant parts of the building.

REINFORCING FOR TOP SLAB. To be effective, reinforcing should be supported well above the bottom of slab, especially over joists. If no chairs are supplied for this purpose, pieces of tile should be inserted under reinforcing at intervals. When concrete decks are not covered with wood top floors, cracks parallel to and above the joists are almost certain to be seen in the finished work if the reinforcing at right angles to joists is not above the center of the concrete slab over the joists.

WOOD SLEEPERS. When wood sleepers are provided, they must be supported at least one full inch above the top of joists to provide a layer of concrete fire-proofing under the sleeper. The Seller provides chairs for supporting and fastening the sleepers in their proper position. These should be installed after the floor lath is attached.

PLACING OF CONCRETE. The concrete should be placed in strips at right angles to run of joists. Placing in strips parallel to joists results in severe lateral stresses, which are liable to pull joists out of place and lead to construction accidents.

MECHANICAL TRADES. Plumbers, electricians and others should not attempt to move joists which interfere with their pipes or conduits, but should request the general contractor to have such joists moved as unduly hamper their work. Cutting of web members or parts of chord sections from open web joists must not be permitted under any circumstances. The Seller accepts no responsibility for the strength of any joist which has been cut, bent or otherwise changed from the condition in which it was originally fabricated.

Explanation of Standard Loading Tables

All steel joists, other than those having a nailing strip attached, manufactured by Member Companies, are made in accordance with the Standard Loading Table for Open Web Joists as given in Simplified Practice Recommendation No. R94-30 of the Bureau of Standards of the United States Department of Commerce.

Joists longer than those shown in table are not manufactured under Steel Joist Institute sponsorship.

Joists shorter than shown in table are made when for any reason, it is not practical to use shallow joists for shorter spans. In computing the carrying capacity of shorter joists, the end reaction should be divided by one-half of the span to determine the safe load per linear foot.

The Steel Joist Institute designation is composed of two or three figures, the first figure or first two figures being the depth in inches and the last figure designating the chord sections. The larger numbers designate larger chord sections. These chord sections vary in properties according to the manufacturer, but in each case the area, radius of gyration and unsupported length (in the case of struts) is such as to result in a resisting moment equal to that required in table when designed in accordance with the Steel Joist Institute Standards and the provisions of the accompanying specifications.

The web systems of joists vary in details according to the manufacturer, but in each case are safe for the designated maximum end reaction, and the web system is designed to support a uniformly distributed load equal to twice the maximum end reaction.

The depth as given in inches is the overall depth with a permissible variation of not over one-quarter (¼") inch, which variation is necessary due to manfacturing processes.

SEE PAGE 15 FOR INSTITUTE APPROVED STANDARD LOADING TABLE

FOR OPEN WEB STEEL JOISTS

FOR LOADING TABLES ON NAILER JOISTS, REFER TO CATALOGS OF INDIVIDUAL MANUFACTURERS.

Properties and Allowable Total Loads in Pounds per Linear Foot of

STEEL JOIST INSTITUTE STANDARD

Open Web Steel Joists

In accordance with Simplified Practice Recommendation No. R 94-30 of the Bureau of Standards, U. S. Dept. of Commerce.

Adopted by Steel Joist Institute Aug. 20, 1929. Effective Jan. 1, 1930

Steel Joist Institute Designation	SJ81	SJ82	SJ102	SJ103	SJ104	SJ123	SJ124	SJ125	SJ126	SJ145	SJ146	*SJ147	SJ166	*SJ167	Steel Joist Institute Designation
Depth in Inches	8	8	10	10	10	12	12	12	12	14	14	14	16	16	Depth in Inches
Resisting Moment In Inch Pounds	29,500	52,500	63,000	82,000	100,000	92,000	115,000	142,000	175,000	156,000	205,000	246,000	232,000	281,000	Resisting Moment In Inch Pounds
Maximum End Reaction In Pounds	1600	1900	1900	1950	2200	2200	2300	2500	2700	2900	3100	3400	3200	3600	Maximum End Reaction In Pounds
Span 4 Feet	800														Span 4 Feet
5	640														5
6	530														6
7	402														7
8	308														8
9	243														9
10	197	350													10
11	162	289													11
12	137	243	292												12
13	116	207	248												13
14	100	178	214												14
15	87	155	187	243		272									15
16	77	137	164	213	260	240									16
17			145	189	230	212									17
18			130	169	205	189	236								18
19			116	151	184	170	212			288					19
20			105	137	167	153	192	237		260					20
21						139	174	215		236					21
22						127	158	196	241	215					22
23						116	145	179	221	197	258				23
24						106	133	164	202	180	237				24
25										166	218	262	247		25
26										154	202	243	229		26
27										143	187	225	212	257	27
28										133	174	209	197	239	28
29													184	223	29
30													172	208	30
31													161	195	31
32													151	183	32

*Note. These Joists are not produced by all Manufacturers.

SEE PAGE 14 FOR EXPLANATION OF LOADING TABLE

BRIDGING

THERE are, in general, four different types of bridging in use by members of the Steel Joist Institute. Each of these types complies with the provisions of Section 108 of the Standard Specifications for Steel Joists and are shown in outline form by the illustrations on this page. For specific details regarding them, the reader is referred to the catalogs of the individual joist manufacturers whose names appear on page 1.

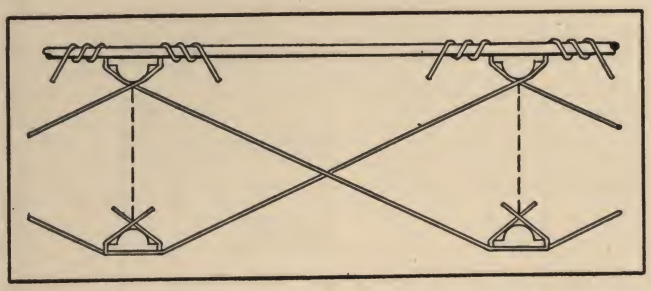

Fig. 1

ROD BRIDGING

The diagonal members of this type of bridging (Fig. 1) are capable of resisting tension only and should consist of round rods of a diameter not less than 3/16". They are supplemented by a continuous strut, equivalent in area to that of a ½" round rod, extending between the top chords of all joists so bridged. This type of bridging can be applied to any of the joists manufactured by members of the Institute.

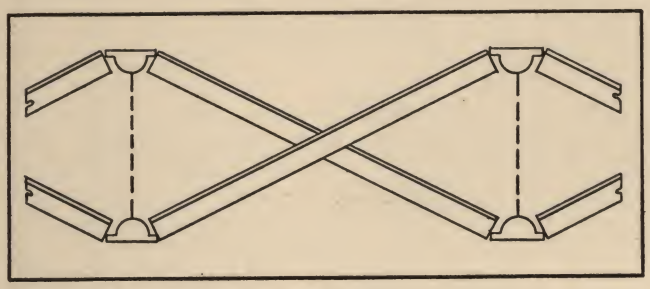

Fig. 2

STRUT BRIDGING

The diagonal members of this type of bridging (Fig. 2) are capable of resisting both tension and compression and are made from either steel channel or angle sections, depending upon the standards of the individual joist manufacturer.

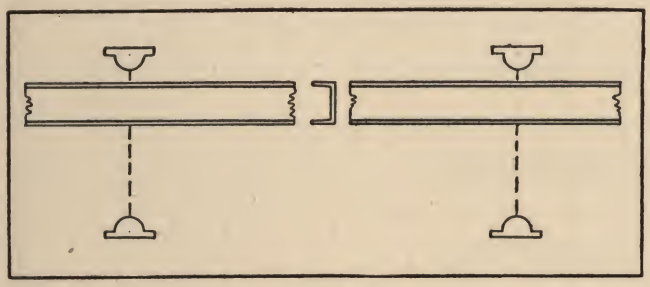

Fig. 3

BEAM BRIDGING

In this type of bridging a horizontally placed 2" beam or equivalent angle section (Fig. 3) is so connected to the joists that it supports the top chords against lateral movement. Fourteen (14) gauge wire diagonals (not shown in Fig. 3) shall be used to secure the bottom chord at each line of bridging.

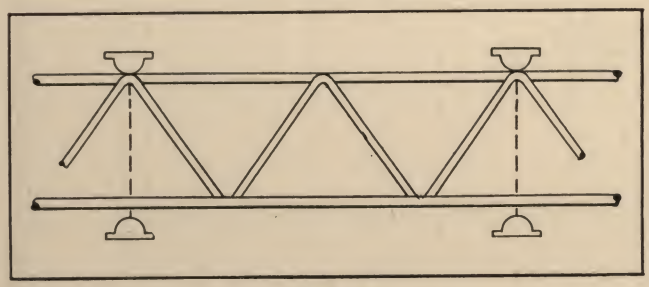

Fig. 4

PORTAL BRIDGING

This type of bridging is furnished in the form of light welded trusses (Fig. 4) connected to the top chords of the joists and to web members near the bottom chords, or furnished in the form of horizontally placed beam or angle sections (similar to Fig.3 and so connected to the joists as to restrain both top and bottom chords against lateral movement. Fourteen (14) gauge wire diagonals may be omitted when this type of bridging is used.